Geophysical Research Abstracts
Vol. 19, EGU2017-3631, 2017
EGU General Assembly 2017

Statistical downscaling of mean temperature, maximum temperature, and minimum temperature on the Loess Plateau, China

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Climate change is considered to be one of the greatest environmental threats. This has urged scientific communities to focus on the hot topic. Global climate models (GCMs) are the primary tool used for studying climate change. However, GCMs are limited because of their coarse spatial resolution and inability to resolve important sub–grid scale features such as terrain and clouds. Statistical downscaling methods can be used to downscale large–scale variables to local–scale. In this study, we assess the applicability of the widely used Statistical Downscaling Model (SDSM) for the Loess Plateau, China. The observed variables included daily mean temperature (TMEAN), maximum temperature (TMAX) and minimum temperature (TMIN) from 1961 to 2005. The and the daily atmospheric data were taken from reanalysis data from 1961 to 2005, and global climate model outputs from Beijing Normal University Earth System Model (BNU–ESM) from 1961 to 2099 and from observations . The results show that SDSM performs well for these three climatic variables on the Loess Plateau. After downscaling, the root mean square errors for TMEAN, TMAX, TMIN for BNU–ESM were reduced by 70.9%, 75.1%, and 67.2%, respectively. All the rates of change in TMEAN, TMAX and TMIN during the 21st century decreased after SDSM downscaling. We also show that SDSM can effectively reduce uncertainty, compared with the raw model outputs. TMEAN uncertainty was reduced by 27.1%, 26.8%, and 16.3% for the future scenarios of RCP 2.6, RCP 4.5 and RCP 8.5, respectively. The corresponding reductions in uncertainty were 23.6%, 30.7%, and 18.7% for TMAX, ; and 37.6%, 31.8%, and 23.2% for TMIN.